

UPDATED INFORMATIVE DIGEST

Section Affected: Amendments to title 13, California Code of Regulations, section 2263(b).

Summary of Changes

California's Phase 2 reformulated gasoline (Phase 2 RFG) regulations establish specifications for eight properties of gasoline effective March 1, 1996. The specifications include limits on the content of benzene, aromatic hydrocarbons, olefins and sulfur. Staff proposed that the Board amend the designations of the test methods for measuring the content of these components according to Table 1.

Staff has arrived at these recommendations after several years of cooperative effort with members of the regulated industry, in particular the Western States Petroleum Association's (WSPA) Working Group on Fuels Test Methods and Subcommittee D2 of the American Society of Testing and Materials (ASTM). Staff has also carefully evaluated the test methods required by the U.S. Environmental Protection Agency (U.S. EPA).

Table 1. Proposed Test Method Changes

<u>Regulated Component</u>	<u>Currently Adopted Method</u>	<u>Proposed Method</u>
Benzene	ASTM D3606-87 MLD 116 (If ethanol present)	ASTM D5580-9x
Aromatic Hydrocarbons	MLD 116	ASTM D5580-9x
Olefins	ASTM D1319-89	ASTM D1319-9x ^a
Sulfur 10 ppm and above	ASTM D2622-87	ASTM D2622-94 ^{b, c} or ASTM D5453-93
1 ppm to < 10 ppm		ASTM D5453-93

^a The published precision statement for this method will be replaced by a precision statement derived from recent ASTM-sponsored interlaboratory testing using oxygenated gasolines.

^b The published precision statement for this method was replaced by a precision statement based on data from recently completed interlaboratory testing conducted by WSPA with participation from ARB.

^c The published calibration procedure of this method is superseded by a procedure that is more accurate for low sulfur content gasoline.

Rationale for Changes

Benzene

Staff proposed that the Board designate ASTM D5580-9x (the current draft revision of this test method) in place of ASTM D3606-87 and MLD 116 for measuring benzene in gasoline. MLD 116 was adopted for gasolines containing ethanol because it was recognized that ethanol interferes with the benzene determination using ASTM D3606.

ASTM D5580-9x is more reproducible than the currently adopted method and does not have the interferences that both adopted methods were shown to have. ASTM D5580-9x is considerably more cost effective and practical than several of the alternative methods although not quite as precise. Methods for measuring benzene are usually linked to the determination of total aromatics and therefore in selecting a suitable method, both measurements were considered together.

Aromatic Hydrocarbons

Staff proposed that the Board designate ASTM D5580-9x for measuring the aromatic hydrocarbon content of gasoline. The currently adopted method, MLD 116, has potential interferences that do not appear in ASTM D5580. Recent interlaboratory testing has shown ASTM D5580-9x to be the most precise of several methods including GC/MS, the method adopted by the U.S. EPA, GC/FTIR, and ASTM D1319. In addition to being more precise, ASTM D5580 is also more cost effective and practical than the alternative methods considered.

Interlaboratory testing of identical gasoline samples has shown that differences in measurement results exist among the candidate methods. ASTM D5580 measurement results of total aromatic hydrocarbon content were slightly higher than results from other methods and this is of some concern to industry representatives. Further testing is underway at several laboratories to investigate the source(s) of the discrepancy among all the aromatics test methods. Nevertheless, the consensus of the ASTM and WSPA participants at this time is that ASTM D5580 is the best method available from the standpoint of precision, cost effectiveness and practicality.

Olefins

Staff proposed that the designated test method for measuring olefins in gasoline be changed from ASTM D1319-89 to ASTM D1319-9x (the current draft revision of this test method). D1319-9x is identical in most respects to D1319-89 except that the scope of the method has been expanded to include oxygenated gasolines.

Staff also proposed to add regulatory language to modify the precision statement incorporated with the method. The precision statement in ASTM D1319-9x is not applicable to oxygenated gasolines. The proposed precision statement was obtained from recent interlaboratory testing carried out by ASTM participants and will eventually be added to the test method.

Sulfur

Staff proposed that several changes be made to the designated test method for measuring sulfur in gasoline. First, the currently designated test method, ASTM D2622-87, should be redesignated to ASTM D2622-94, the latest revision of that test method. ASTM D2622-94 contains only editorial changes relative to ASTM D2622-87. However, staff proposed to add regulatory language to update the calibration procedure and the precision statement of ASTM D2622-94. The change in calibration procedure is needed to make the method more accurate for measuring the low levels of sulfur in Phase 2 gasoline. The change in the precision statement is necessary because the current precision statement is outdated and not readily applicable to Phase 2 gasoline. The new precision statement is based on interlaboratory testing completed recently. This testing was sponsored by WSPA with ARB participation. The interlaboratory testing was carried out following ASTM protocol and used a wide range of low-sulfur Phase 2 gasoline.

The second proposed change was the designation of a new test method, ASTM D5453-93, for measuring very low sulfur gasoline; sulfur at levels between 1 and 10 ppm. Measurements using ASTM D2622-94 become very imprecise below 10 ppm. Because of the RFG regulations' averaging provisions and allowances made for alternative formulations, it is anticipated that gasoline blends will be produced at concentrations well below the flat limit of 40 ppm. ASTM D5453-93 was proposed because it is applicable in the concentration range of interest and is reasonably precise.

ASTM D5453-93 is also applicable in the higher concentrations covered by ASTM D2622 and has a similar reproducibility. Thus the final proposed change for the designated sulfur test method was the designation of ASTM D5453-93 as an alternate test method to ASTM D2622-94 when measuring sulfur at concentrations of 10 ppm and above. The designation of ASTM D5453-93 as an alternate method will permit laboratories to utilize one method for making both high and low sulfur measurements.

Federal Requirements

The U.S. Environmental Protection Agency (U.S. EPA) administers regulations requiring that gasoline sold in various areas with poor air quality meet standards for "federal" reformulated gasoline. These regulations have applied in most of Southern California since December 1994. The test procedures required by federal regulations are shown in Table 2 (40 C.F.R. sec 80.46(g)).

The ARB has worked with the U.S. EPA and gasoline producers to avoid unnecessary duplication and conflicts between the federal and state enforcement requirements. As a result of this cooperative effort, the federal regulations allow producers and importers of California gasoline to use a test method specified in the ARB's Phase 2 RFG regulations in lieu of the otherwise applicable federal method. (40 C.F.R. sec. 80.81(h)).

Table 2. Comparison of U.S. EPA vs ARB Test Procedures

<u>Regulated Component</u>	<u>U.S. EPA Method</u>	<u>ARB Proposed Method</u>
Benzene	ASTM D3606-87	ASTM D5580-9x
Aromatics	GC/MS or ASTM D1319-89 with correlation to GC/MS until 1997	ASTM D5580-9x
Olefins	ASTM D1319-89	ASTM D1319-9x
Sulfur	ASTM D2622-87	ASTM D2622-94 or ASTM D5453-93 w/correlation to ASTM D2622-94

15-Day Changes

At the Board Hearing staff noted the following changes from staff's original proposals in the staff report:

(1) Defined a reporting limit for all test methods used for measuring Phase 2 RFG specifications. This reporting limit was set equal to the method's limit of detection. If the method's limit of detection is not known then the reporting limit is the lower limit of applicability of the method as defined in the methods scope.

This addition was made to clarify agency policy on reporting of values for averaging purposes. ARB policy is to accept values that are at or above the method's limit of detection or quantitation.

(2) Allowed the use of ASTM D2622-94 (with modified calibration procedure) down to 10 ppm instead of 30 ppm as originally proposed and removed the requirement for a bias correction when reporting results using ASTM D5453-93. Updated the reproducibility of ASTM D2622-94 (modified).

Interlaboratory test data obtained immediately prior to the Board Hearing showed that ASTM D2622-94 was adequately precise for measurements down to 10 ppm sulfur. Furthermore parallel tests on identical samples showed that no significant bias exists between ASTM D2622-94 and ASTM D5453-93 and therefore no bias correction is necessary.

(3) Extended the applicability of the reproducibility equation of ASTM D1319-9X from 4.0 volume percent to 0.3 volume percent.

Because the CaRFG regulations allow averaging and alternative gasoline formulations as compliance options, it is likely that gasoline with olefin content well below the flat limit of 4.0 volume percent will be produced. For this reason, the reproducibility of ASTM D1319-9X must be established for these lower levels. ARB staff and industry have agreed that extrapolating the equation relating reproducibility and concentration to the lower limit of the method (0.3 volume percent) is the most practical solution until testing at the lower levels can be accomplished. The reproducibilities of aromatics and saturates in gasoline as measured by ASTM D1319-9X has been deleted because they are not relevant to the measurement of olefin content.

(4) The designated test method for benzene and aromatics was changed to ASTM D5580-95 from ASTM D5580-9X.

The two test methods are substantively identical. ASTM D5580-95 is the version of the test method that has been given final approval by the ASTM.